or private individuals. Prior to 1911 there was nothing in the law to prevent the commissioners employing an outside engineer to handle county work. In that year a law was enacted giving to the surveyor, if competent, the legal county work. More recent legislation has placed him on a salary. By logical inference the legal status of the surveyor by rights should put him at the head of all county public work in which taxation figures or the public is concerned.

Every separate county officer should have assigned to him the exclusive conduct of all affairs properly connected with his office, thereby preventing duplication of duty and mixed responsibility. If such work requires assistance, then such county officers should be legalized to employ deputies properly to perform the service for which the taxpayers pay and to which the public is entitled. A divided responsibility is dangerous and costly.

But the most costly, most neglected, and sometimes most poorly handled county affairs involve roads and drains. Miles of each are rendered useless every year because "orphaned" by divided responsibility.

You may ask, "Will a surveyor in exclusive charge make matters better?" Yes, for what is a man's exclusive business is rarely neglected. At least responsibility could be located, and the people are not slow to correct a grievance when once they find the cause.

SURFACE-TREATED GRAVEL AND RETREAD ROAD WORK

By Kenneth Sparks, Grant County Highway Superintendent

Indiana is proud of her system of gravel and macadamized roads developed during the past generation until they are the envy of our neighboring states. These roads have served the traffic they were called upon to bear. With such a large mileage of these improved highways, traffic seldom finds it necessary to use mud roads. We have almost forgotten what mud roads are in Grant County. Our system of gravel roads has expanded until today we have over 900 miles. Almost all of the roads in our county are improved with stone, gravel, or some higher type of surfacing.

The taxpayers provided the money to build these roads and we are proud of them. Maintenance under horse and buggy traffic was simple and economical. We added a little new gravel occasionally and we honed the surface smooth with a horse drag or grader so that it was pleasant to travel. The road was entirely satisfactory and the maintenance cost was modest. Our highway problem seemed to be solved.

But, during the past 10 or 15 years, the type and volume of traffic has changed more than most of us ever dreamed. Our gravel roads, where they are subjected to excessive high-speed traffic, are very difficult to hold. They are dusty, rough, and dangerous. We are now criticised because we are not keeping up the roads in first-class condition. When we sit down and analyze what it is costing for the work we are doing to try to hold these heavy traffic gravel roads, we get a terrible shock. The cost is entirely too high.

We have in our county probably 200 miles of gravel roads that might be classed as heavy-traffic roads. These roads are very difficult to keep in good condition and account for a large proportion of our maintenance funds. The old saying is, "All roads lead to Rome." Our program is to surface-treat, or retread, 75 miles which lead to state roads or to Marion, our county seat. The other 125 miles, which now require expensive maintenance, will then become secondary roads, because the treated roads will attract much of the traffic from this latter mileage.

If the taxpayers would dig down into their pockets and invest another million and a half to two million dollars, these 75 miles could be paved. We would be proud of this pavement and the maintenance cost would be reduced by hundreds of dollars. This, however, cannot be the solution of our problem, for the taxpayers simply refuse to permit such a large expenditure.

We considered that the change in traffic might be met with a change in maintenance methods. Horse and buggy methods served horse and buggy traffic. Traffic in 1931 calls for modern methods and modern equipment. In July, 1929, we decided to try tar maintenance of gravel roads. We treated a one-mile section in less than one working day, and it cost less than $1,000. Traffic used the road the following day without any mess or disagreeable tar splattering on the cars. The result so encouraged us that we treated two more miles the same year. We class this work strictly as maintenance. We do not believe that we can convert gravel roads into pavements simply by adding a little tar. However, the tar does mix with the gravel on the road so that it packs down under traffic and makes a dustless, non-skid, waterproof surface over which it is a pleasure to travel.

We did wonder what would happen to this type of road in the spring. You will recall the extreme conditions we had last spring when most of our heavily travelled roads were almost impassable. Our surface-treated roads needed some patching, and one section, ⅛-mile long, was reshaped with a road grader and retreated with ¼ gallon to the square yard. Our patch work cost us approximately $25 per mile.

Last year we expanded our mileage of treated roads by adding 25 miles. These roads are serving the traffic now. Our

people seem to favor this type of maintenance work. We are satisfied that it will cost less money to maintain these roads than it cost to maintain them as ordinary gravel roads. Our experience leads us to believe that rolling is not desirable on this class of work. Traffic thoroughly compacts the surface. The roller has a tendency to lift the surface while it is tacky.

Equipment for this class of work consists of a road grader, a maintainer, and a distributor. We have treated two miles in a day with such an outfit when we had ideal conditions.

If a gravel road has sufficient base and drainage to come through the spring without excessive failures, then it will surely come through in better shape after the surface has been made both smooth and waterproof with a treatment. We have observed that the tar-treated roads which have been maintained as such for five years or more seem to be firmer and of denser surface that during the first two years. It occurs to us that the weak places are developed and repaired during the first two years so that the road gradually takes on more of the characteristics of a pavement, and maintenance costs decrease.

SURFACE-TREATED GRAVEL AND RETREAD WORK

By H. A. Firestone, Elkhart County Highway Superintendent

Elkhart County, like many others, has gravel or stone roads which, from the standpoint of maintenance, to say nothing of eliminating the dust evil, are exceedingly costly. Besides, one is unable to keep a good riding surface on them if they carry a very large amount of traffic. We were faced with a problem of reconstruction to meet the ever-increasing amount of automobile and truck traffic, as well as a great deal of complaint about dust and rough surface. After a great deal of controversy it was decided to make an inspection trip over some state roads and a few county systems to see how they were handled under these conditions.

The commissioners, the engineer, the attorney, and I made an inspection of various types of treatment and were very favorably impressed. We decided to treat a mile of heavily traveled gravel road for a test. The bituminous material selected for this treatment was C. B. asphalt. There was a gravel washing plant within a mile of the project.

To remove some of the crown from the road we spread gravel along each side and allowed traffic to use it for about six weeks, keeping it dragged to a reasonably smooth surface. The engineer and I made an inspection of this road and found an average of approximately 8 inches of gravel in the roadbed. Asphalt was then applied, using as first application .45 gallon